Title: MILITARY VEHICLE HAVING COOPERATIVE CONTROL NETWORK WITH DISTRIBUTED I/O INTERFACING
Inventor(s): Squires et al.
Docket No: 61300/225

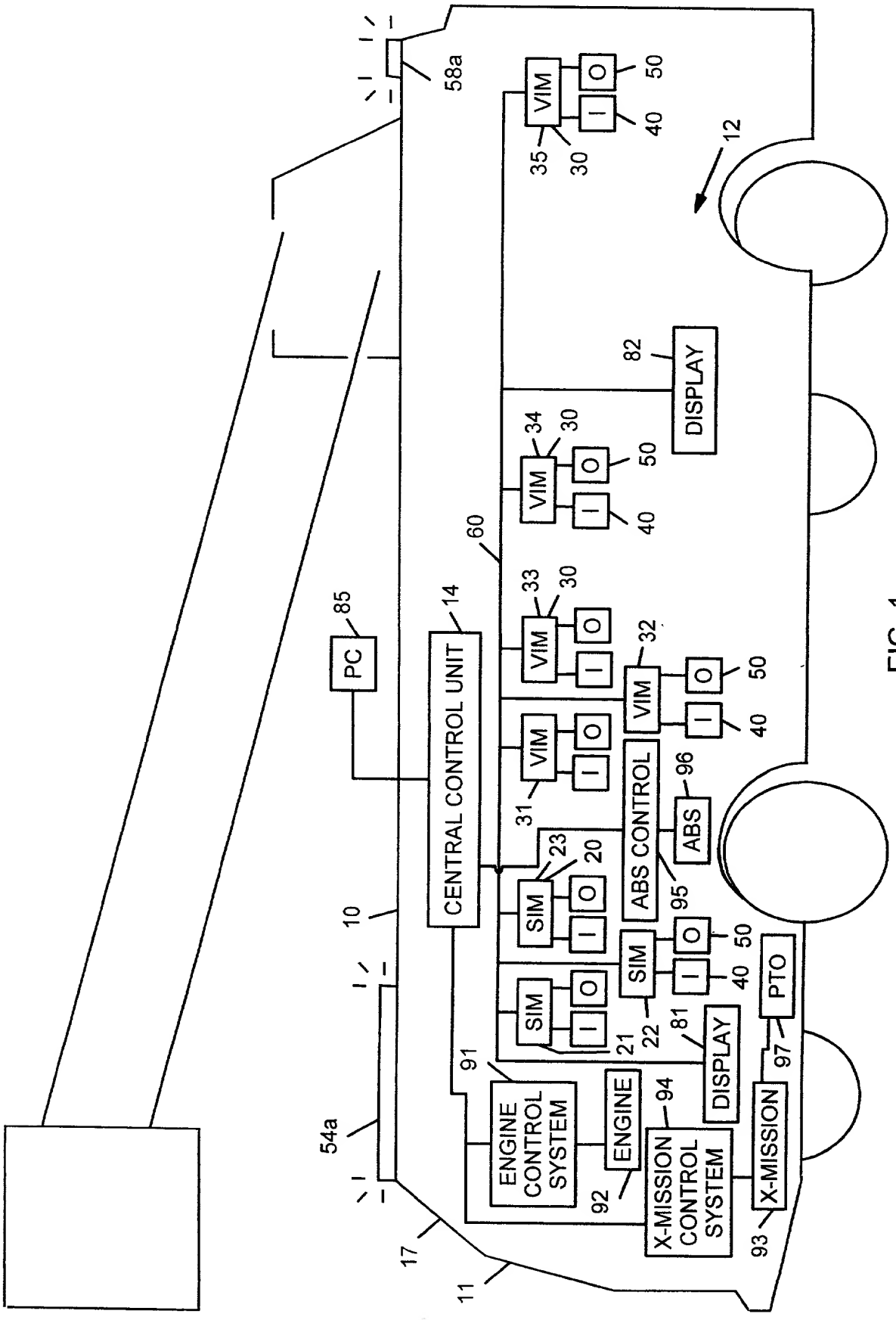

FIG. 1

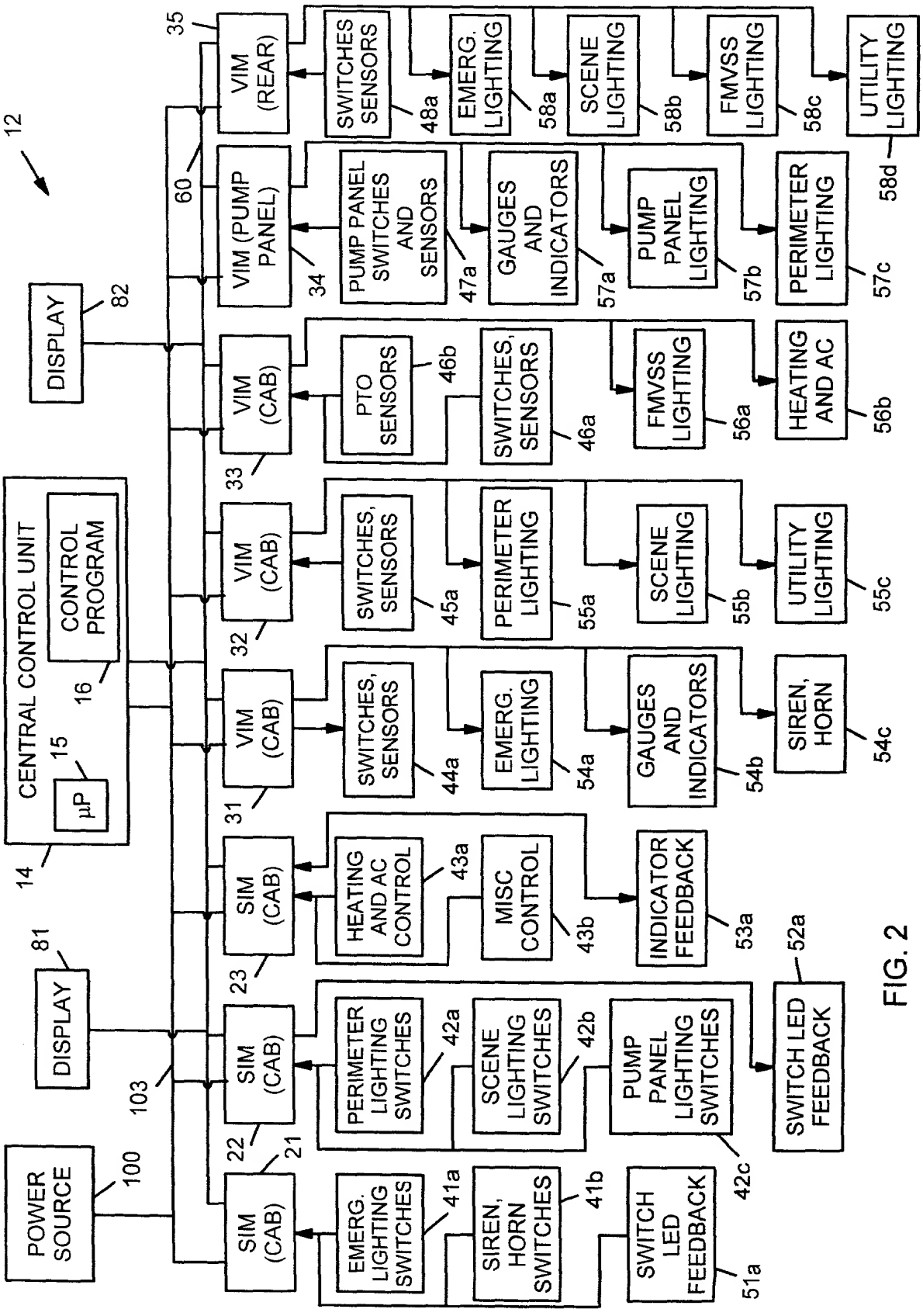
12
POWER SOURCE
100
CENTRAL CONTROL UNIT
14
μP
15
CONTROL PROGRAM
16
DISPLAY
81
DISPLAY
82
103
SIM (CAB)
22
SIM (CAB)
23
SIM (CAB)
21
VIM (CAB)
31
VIM (CAB)
32
VIM (CAB)
33
VIM (PUMP PANEL)
34
VIM (REAR)
35
60
EMERG. LIGHTING SWITCHES
41a
SIREN, HORN SWITCHES
41b
SWITCH LED FEEDBACK
42c
PERIMETER LIGHTING SWITCHES
42a
SCENE LIGHTING SWITCHES
42b
PUMP PANEL LIGHTING SWITCHES
HEATING AND AC CONTROL
43a
MISC CONTROL
43b
INDICATOR FEEDBACK
53a
SWITCH LED FEEDBACK
52a
51a
SWITCHES, SENSORS
44a
EMERG. LIGHTING
54a
GAUGES AND INDICATORS
54b
SIREN, HORN
54c
SWITCHES, SENSORS
45a
PERIMETER LIGHTING
55a
SCENE LIGHTING
55b
UTILITY LIGHTING
55c
PTO SENSORS
46b
SWITCHES, SENSORS
46a
FMVSS LIGHTING
56a
HEATING AND AC
56b
PUMP PANEL SWITCHES AND SENSORS
47a
GAUGES AND INDICATORS
57a
PUMP PANEL LIGHTING
57b
PERIMETER LIGHTING
57c
SWITCHES SENSORS
48a
EMERG. LIGHTING
58a
SCENE LIGHTING
58b
FMVSS LIGHTING
58c
UTILITY LIGHTING
58d

FIG. 2

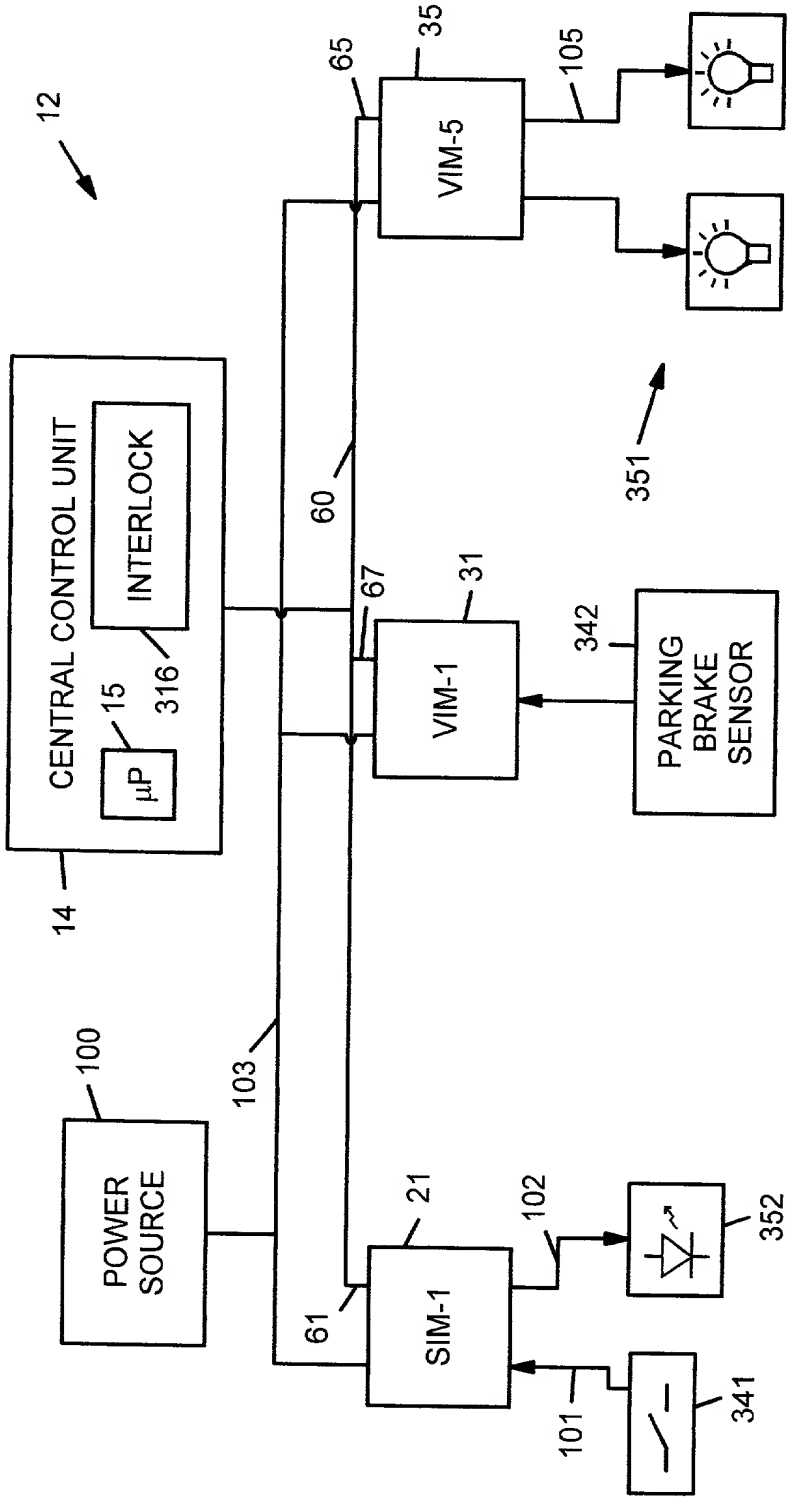
12
CENTRAL CONTROL UNIT
INTERLOCK
μP
15
316
14
VIM-5
65
35
105
60
67
VIM-1
31
342
PARKING BRAKE SENSOR
351
POWER SOURCE
100
103
SIM-1
21
102
352
61
101
341

FIG. 3

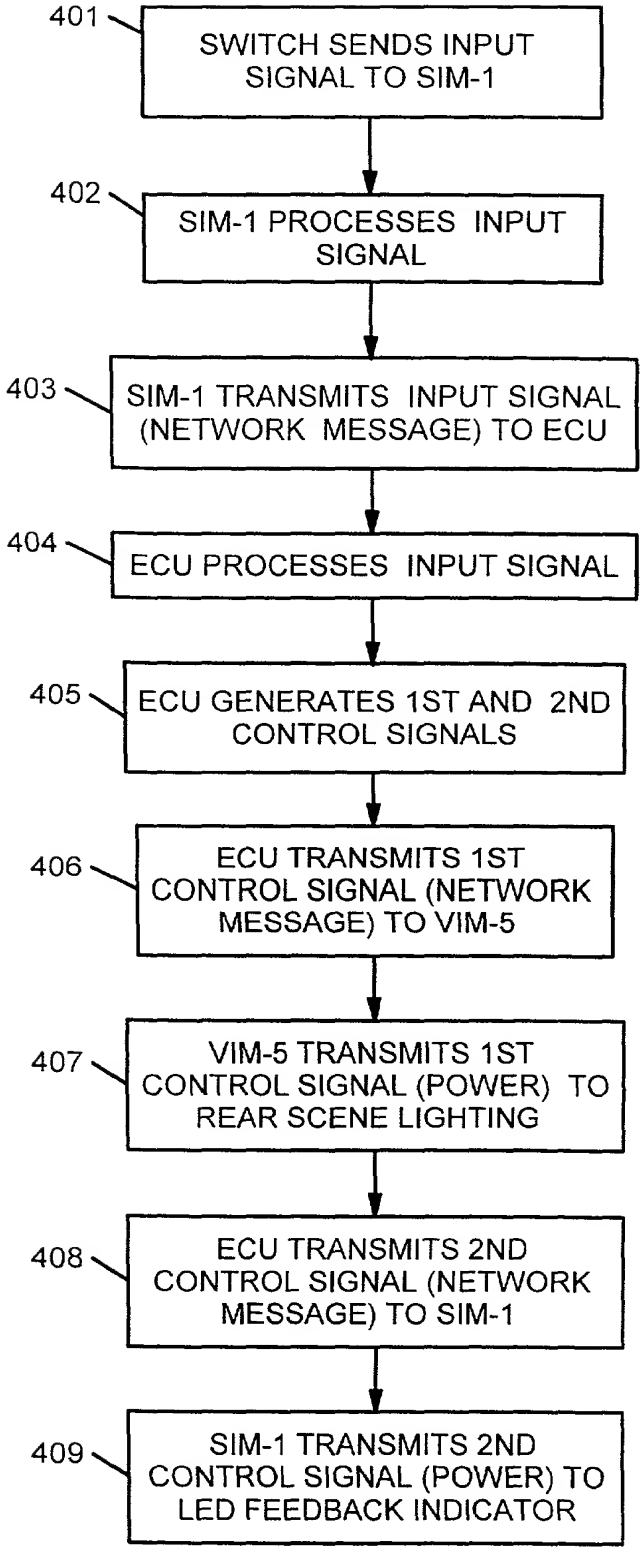
401
SWITCH SENDS INPUT SIGNAL TO SIM-1
402
SIM-1 PROCESSES INPUT SIGNAL
403
SIM-1 TRANSMITS INPUT SIGNAL (NETWORK MESSAGE) TO ECU
404
ECU PROCESSES INPUT SIGNAL
405
ECU GENERATES 1ST AND 2ND CONTROL SIGNALS
406
ECU TRANSMITS 1ST CONTROL SIGNAL (NETWORK MESSAGE) TO VIM-5
407
VIM-5 TRANSMITS 1ST CONTROL SIGNAL (POWER) TO REAR SCENE LIGHTING
408
ECU TRANSMITS 2ND CONTROL SIGNAL (NETWORK MESSAGE) TO SIM-1
409
SIM-1 TRANSMITS 2ND CONTROL SIGNAL (POWER) TO LED FEEDBACK INDICATOR

FIG. 4

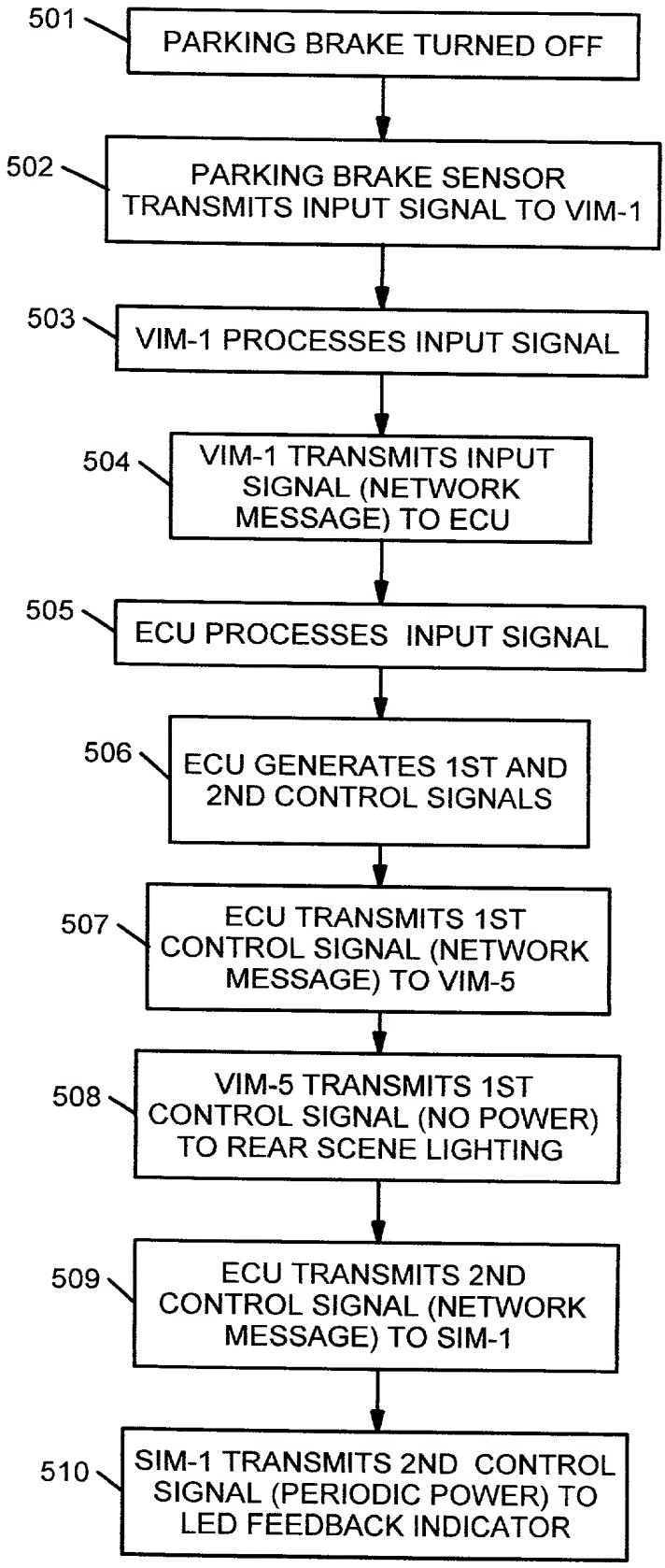
501
PARKING BRAKE TURNED OFF
502
PARKING BRAKE SENSOR TRANSMITS INPUT SIGNAL TO VIM-1
503
VIM-1 PROCESSES INPUT SIGNAL
504
VIM-1 TRANSMITS INPUT SIGNAL (NETWORK MESSAGE) TO ECU
505
ECU PROCESSES INPUT SIGNAL
506
ECU GENERATES 1ST AND 2ND CONTROL SIGNALS
507
ECU TRANSMITS 1ST CONTROL SIGNAL (NETWORK MESSAGE) TO VIM-5
508
VIM-5 TRANSMITS 1ST CONTROL SIGNAL (NO POWER) TO REAR SCENE LIGHTING
509
ECU TRANSMITS 2ND CONTROL SIGNAL (NETWORK MESSAGE) TO SIM-1
510
SIM-1 TRANSMITS 2ND CONTROL SIGNAL (PERIODIC POWER) TO LED FEEDBACK INDICATOR

FIG. 5

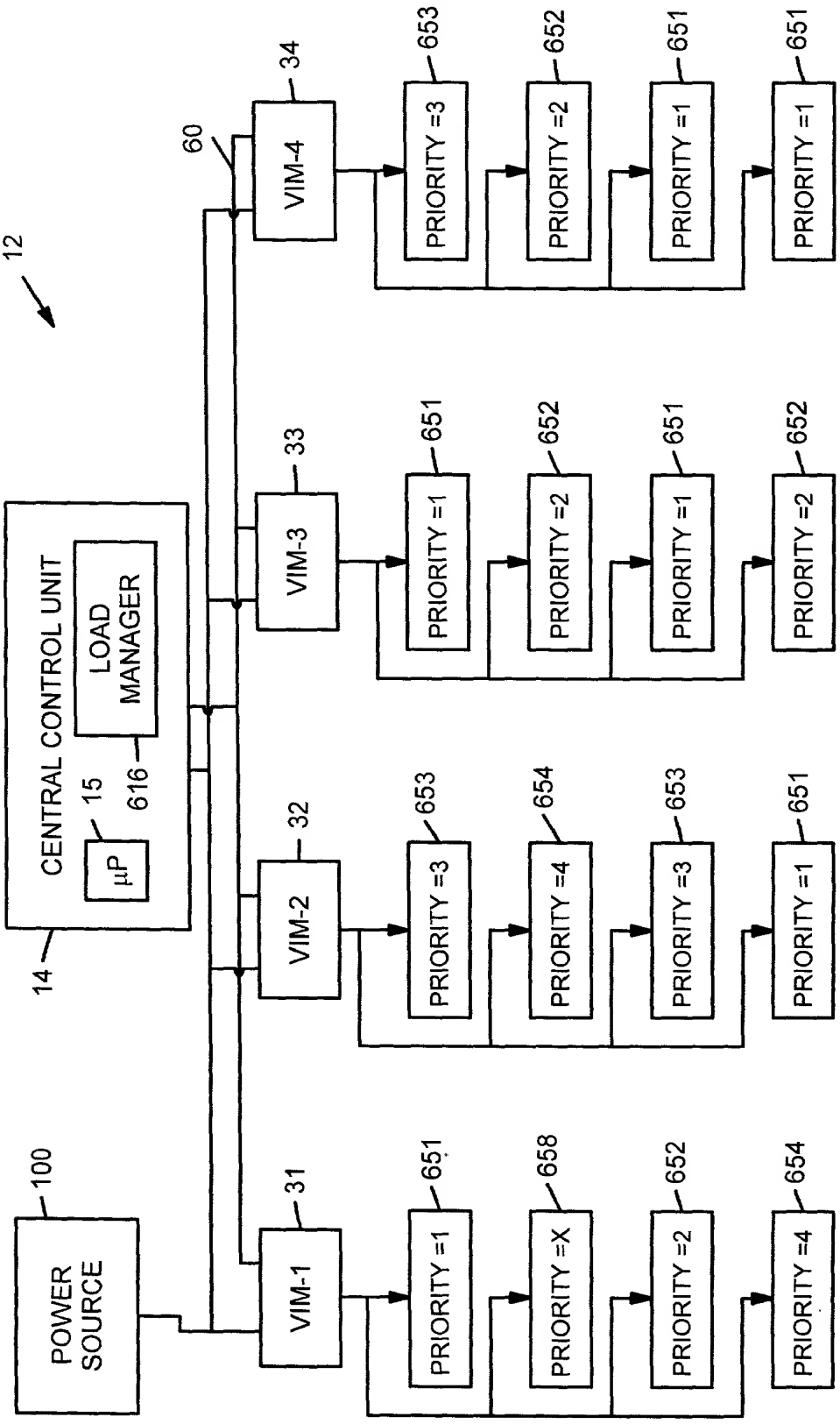
12
14
CENTRAL CONTROL UNIT
LOAD MANAGER
616
μP
15
60
POWER SOURCE
100
VIM-1
31
VIM-2
32
VIM-3
33
VIM-4
34
PRIORITY =1
PRIORITY =X
PRIORITY =2
PRIORITY =4
PRIORITY =3
651
658
652
654
653

FIG. 6

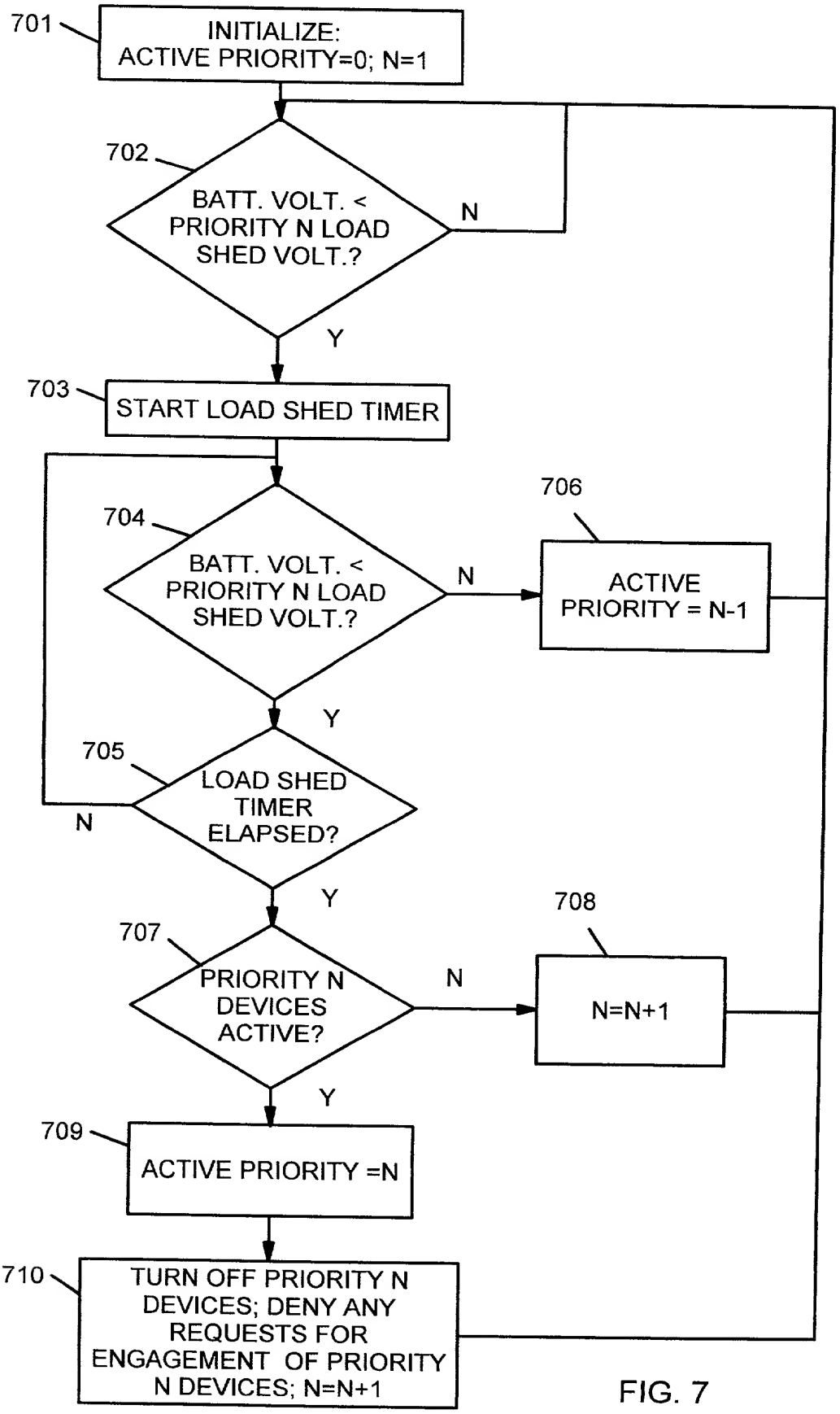
701
INITIALIZE:
ACTIVE PRIORITY=0; N=1
702
BATT. VOLT. < PRIORITY N LOAD SHED VOLT.?
N
Y
703
START LOAD SHED TIMER
704
BATT. VOLT. < PRIORITY N LOAD SHED VOLT.?
N
706
ACTIVE PRIORITY = N-1
Y
705
LOAD SHED TIMER ELAPSED?
N
Y
707
PRIORITY N DEVICES ACTIVE?
N
708
N=N+1
Y
709
ACTIVE PRIORITY =N
710
TURN OFF PRIORITY N DEVICES; DENY ANY REQUESTS FOR ENGAGEMENT OF PRIORITY N DEVICES; N=N+1

FIG. 7

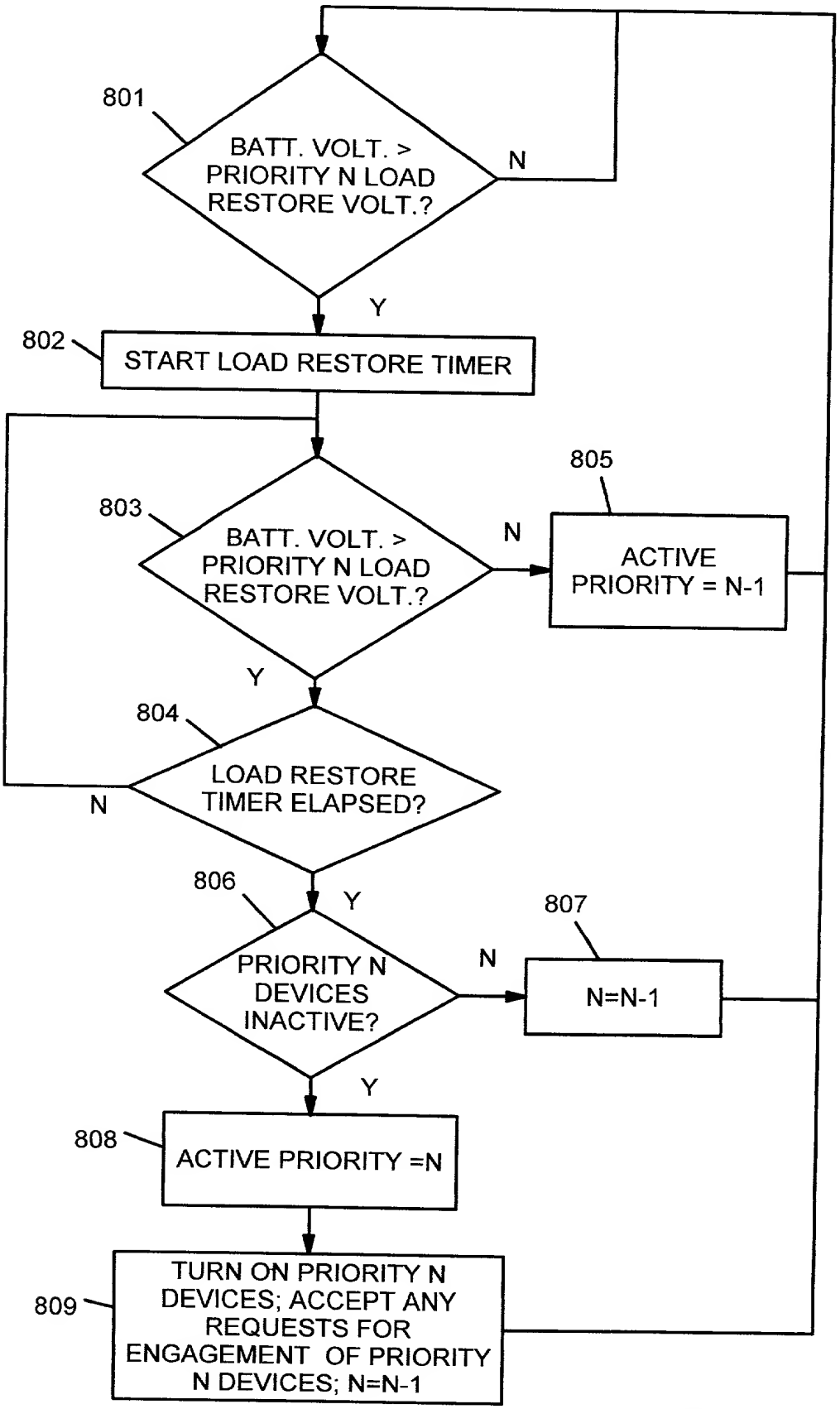
801
BATT. VOLT. > PRIORITY N LOAD RESTORE VOLT.?
N
Y
802
START LOAD RESTORE TIMER
803
BATT. VOLT. > PRIORITY N LOAD RESTORE VOLT.?
N
805
ACTIVE PRIORITY = N-1
Y
804
LOAD RESTORE TIMER ELAPSED?
N
806
PRIORITY N DEVICES INACTIVE?
Y
N
807
N=N-1
Y
808
ACTIVE PRIORITY =N
809
TURN ON PRIORITY N DEVICES; ACCEPT ANY REQUESTS FOR ENGAGEMENT OF PRIORITY N DEVICES; N=N-1

FIG. 8

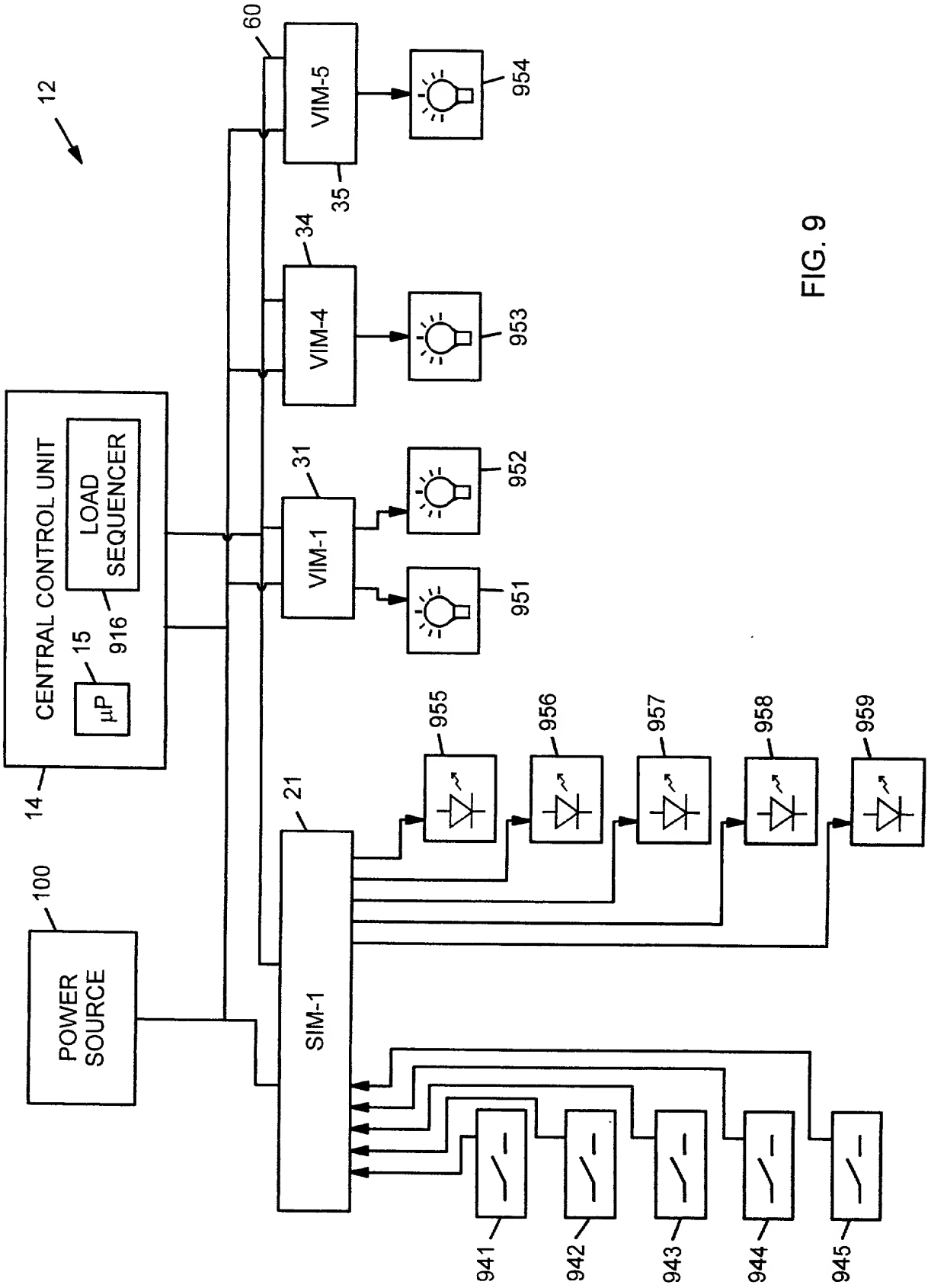
12
60
VIM-5
954
35
34
VIM-4
953
31
VIM-1
952
951
CENTRAL CONTROL UNIT
LOAD SEQUENCER
916
15
μP
14
100
POWER SOURCE
21
SIM-1
955
956
957
958
959
941
942
943
944
945

FIG. 9

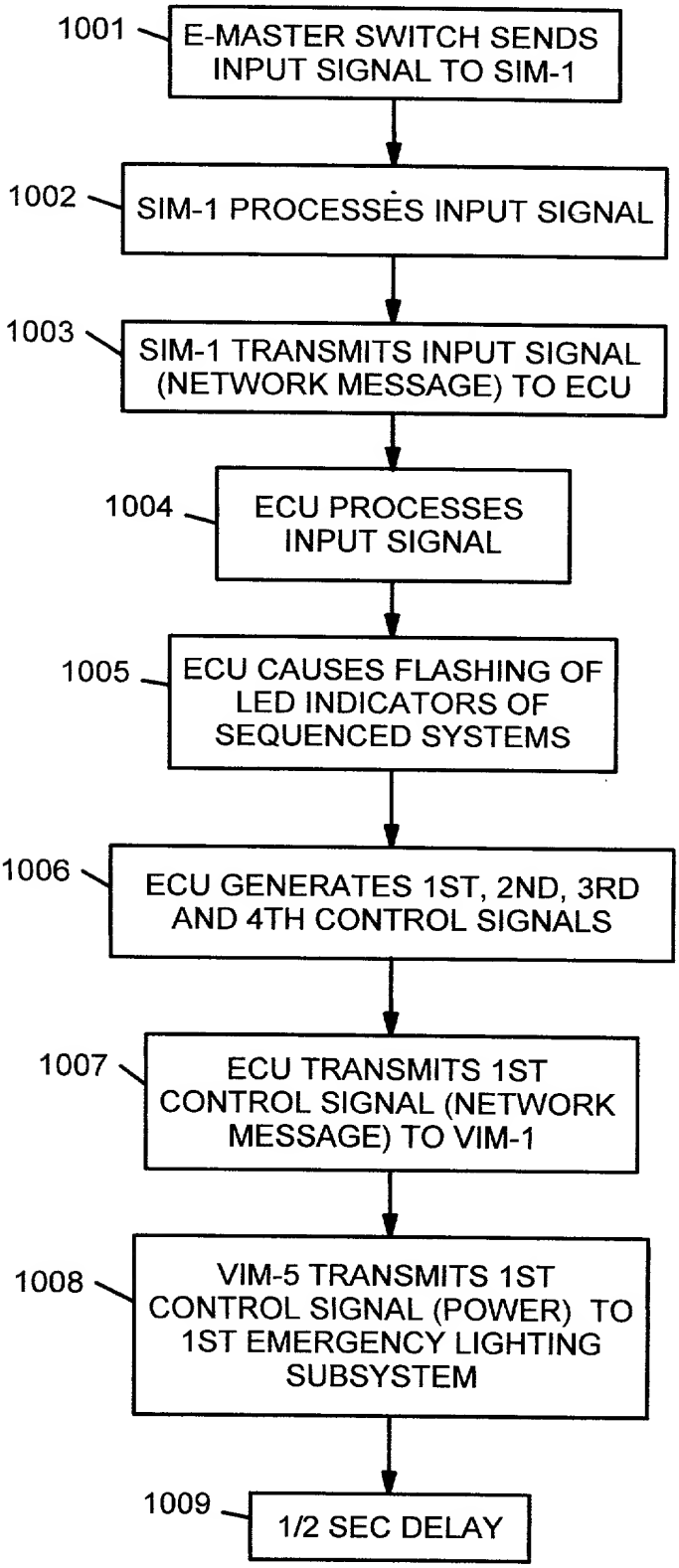
1001
E-MASTER SWITCH SENDS INPUT SIGNAL TO SIM-1
1002
SIM-1 PROCESSES INPUT SIGNAL
1003
SIM-1 TRANSMITS INPUT SIGNAL (NETWORK MESSAGE) TO ECU
1004
ECU PROCESSES INPUT SIGNAL
1005
ECU CAUSES FLASHING OF LED INDICATORS OF SEQUENCED SYSTEMS
1006
ECU GENERATES 1ST, 2ND, 3RD AND 4TH CONTROL SIGNALS
1007
ECU TRANSMITS 1ST CONTROL SIGNAL (NETWORK MESSAGE) TO VIM-1
1008
VIM-5 TRANSMITS 1ST CONTROL SIGNAL (POWER) TO 1ST EMERGENCY LIGHTING SUBSYSTEM
1009
1/2 SEC DELAY

FIG. 10A

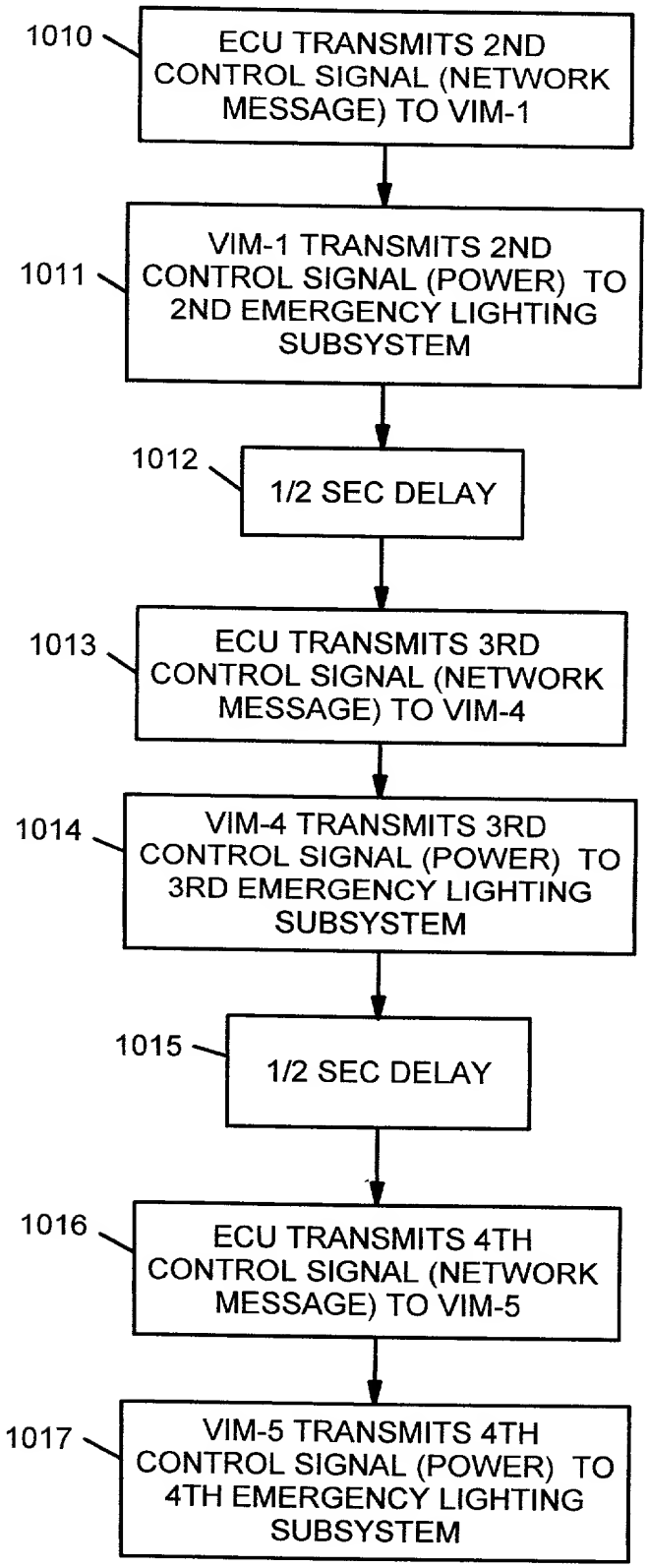
1010
ECU TRANSMITS 2ND CONTROL SIGNAL (NETWORK MESSAGE) TO VIM-1
1011
VIM-1 TRANSMITS 2ND CONTROL SIGNAL (POWER) TO 2ND EMERGENCY LIGHTING SUBSYSTEM
1012
1/2 SEC DELAY
1013
ECU TRANSMITS 3RD CONTROL SIGNAL (NETWORK MESSAGE) TO VIM-4
1014
VIM-4 TRANSMITS 3RD CONTROL SIGNAL (POWER) TO 3RD EMERGENCY LIGHTING SUBSYSTEM
1015
1/2 SEC DELAY
1016
ECU TRANSMITS 4TH CONTROL SIGNAL (NETWORK MESSAGE) TO VIM-5
1017
VIM-5 TRANSMITS 4TH CONTROL SIGNAL (POWER) TO 4TH EMERGENCY LIGHTING SUBSYSTEM

FIG. 10B

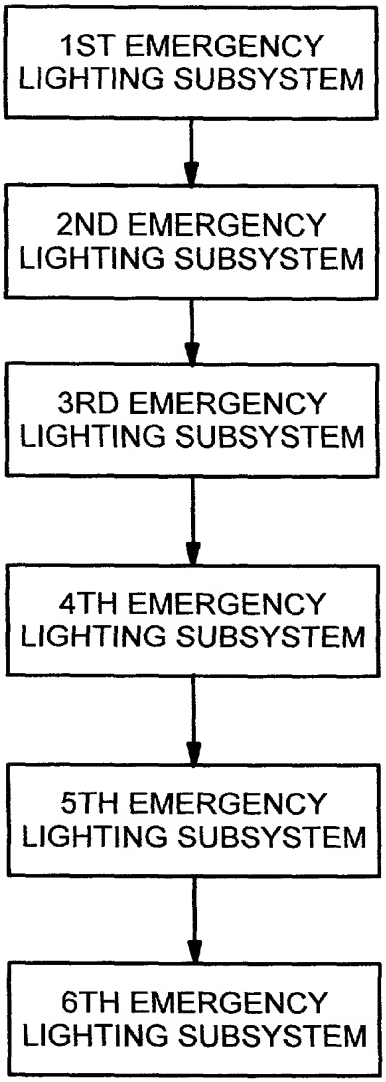

FIG. 11A

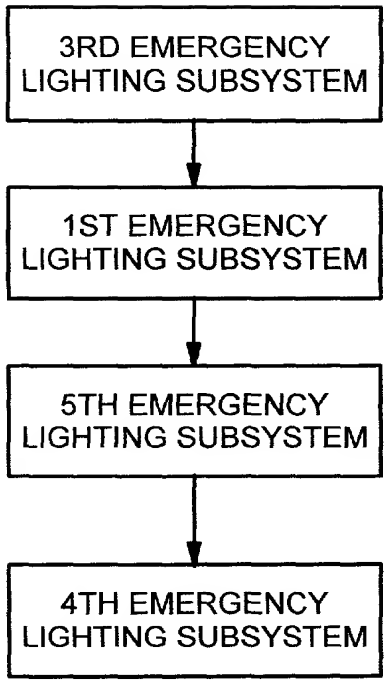

FIG. 11B

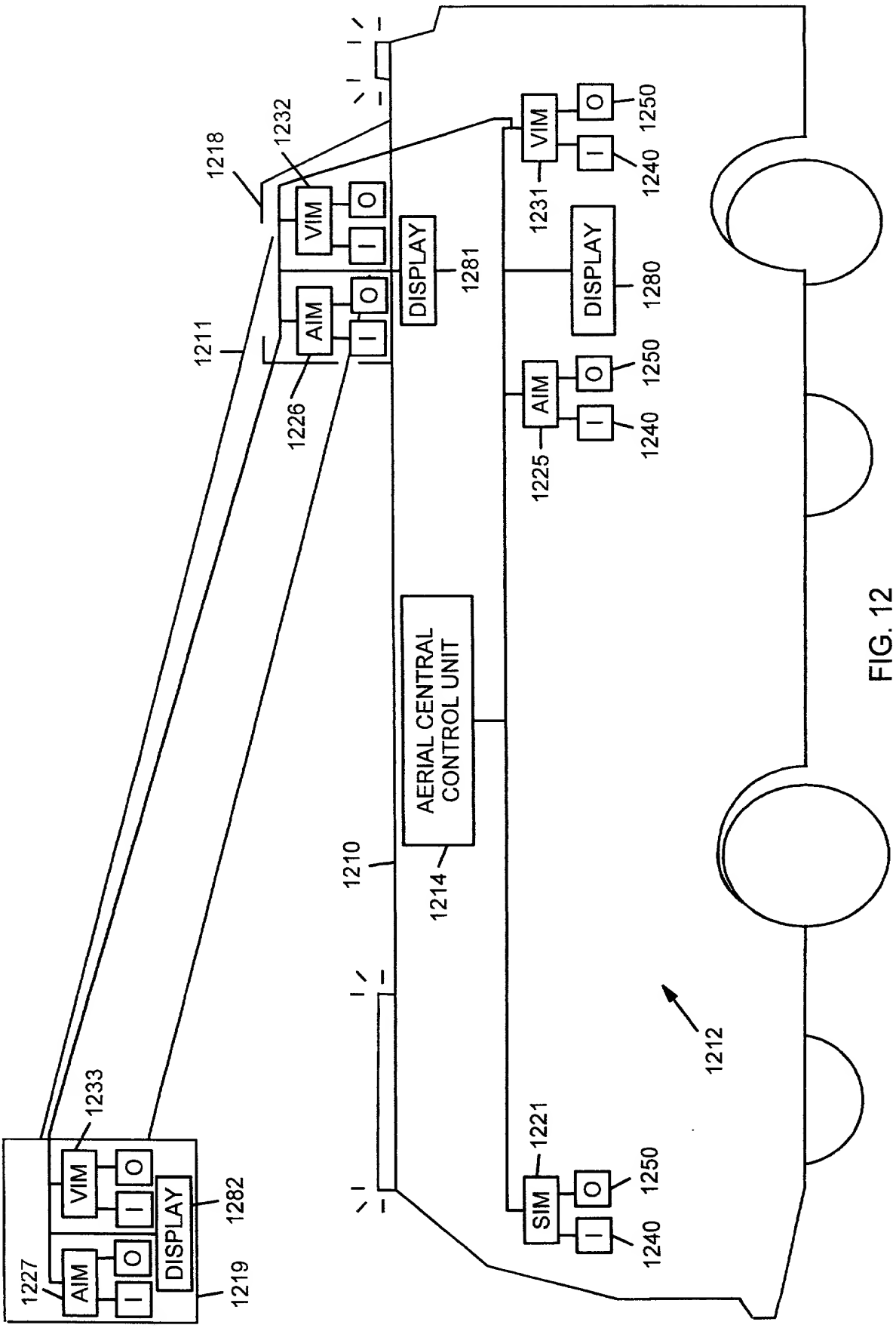
1218
1232
1211
1226
1233
1227
1219
1282
1281
1280
1231
1225
1221
1210
1214
1212
AERIAL CENTRAL CONTROL UNIT
VIM
AIM
SIM
DISPLAY
I
O
1240
1250

FIG. 12

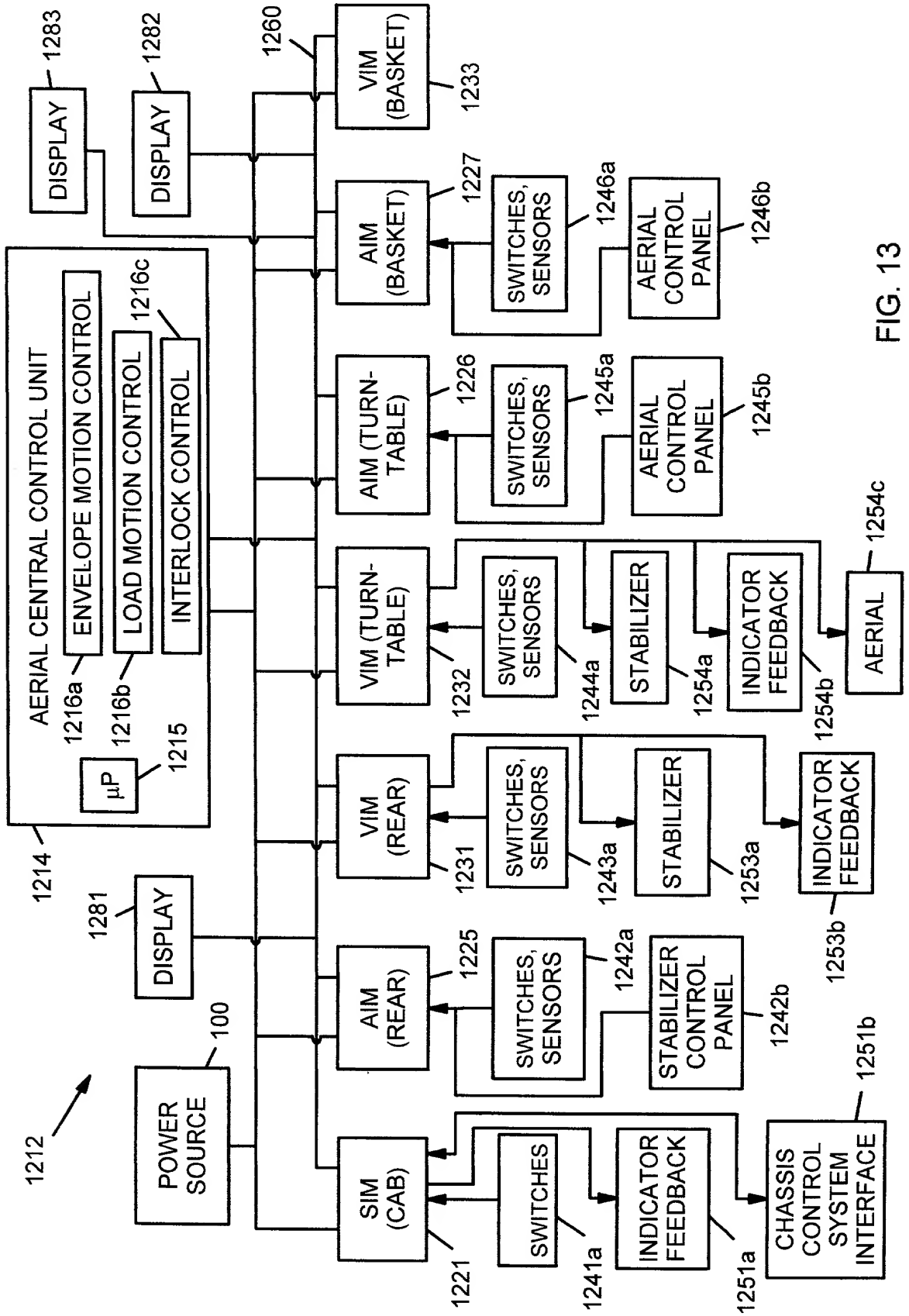
1212
POWER SOURCE
100
SIM (CAB)
1221
SWITCHES
1241a
INDICATOR FEEDBACK
1251a
CHASSIS CONTROL SYSTEM INTERFACE
1251b
AIM (REAR)
1225
SWITCHES, SENSORS
1242a
STABILIZER CONTROL PANEL
1242b
VIM (REAR)
1231
SWITCHES, SENSORS
1243a
STABILIZER
1253a
INDICATOR FEEDBACK
1253b
VIM (TURN-TABLE)
1232
SWITCHES, SENSORS
1244a
STABILIZER
1254a
INDICATOR FEEDBACK
1254b
AERIAL
1254c
AIM (TURN-TABLE)
1226
SWITCHES, SENSORS
1245a
AERIAL CONTROL PANEL
1245b
AIM (BASKET)
1227
SWITCHES, SENSORS
1246a
AERIAL CONTROL PANEL
1246b
VIM (BASKET)
1233
1260
DISPLAY
1281
DISPLAY
1282
DISPLAY
1283
AERIAL CENTRAL CONTROL UNIT
1214
μP
1215
ENVELOPE MOTION CONTROL
1216a
LOAD MOTION CONTROL
1216b
INTERLOCK CONTROL
1216c

FIG. 13

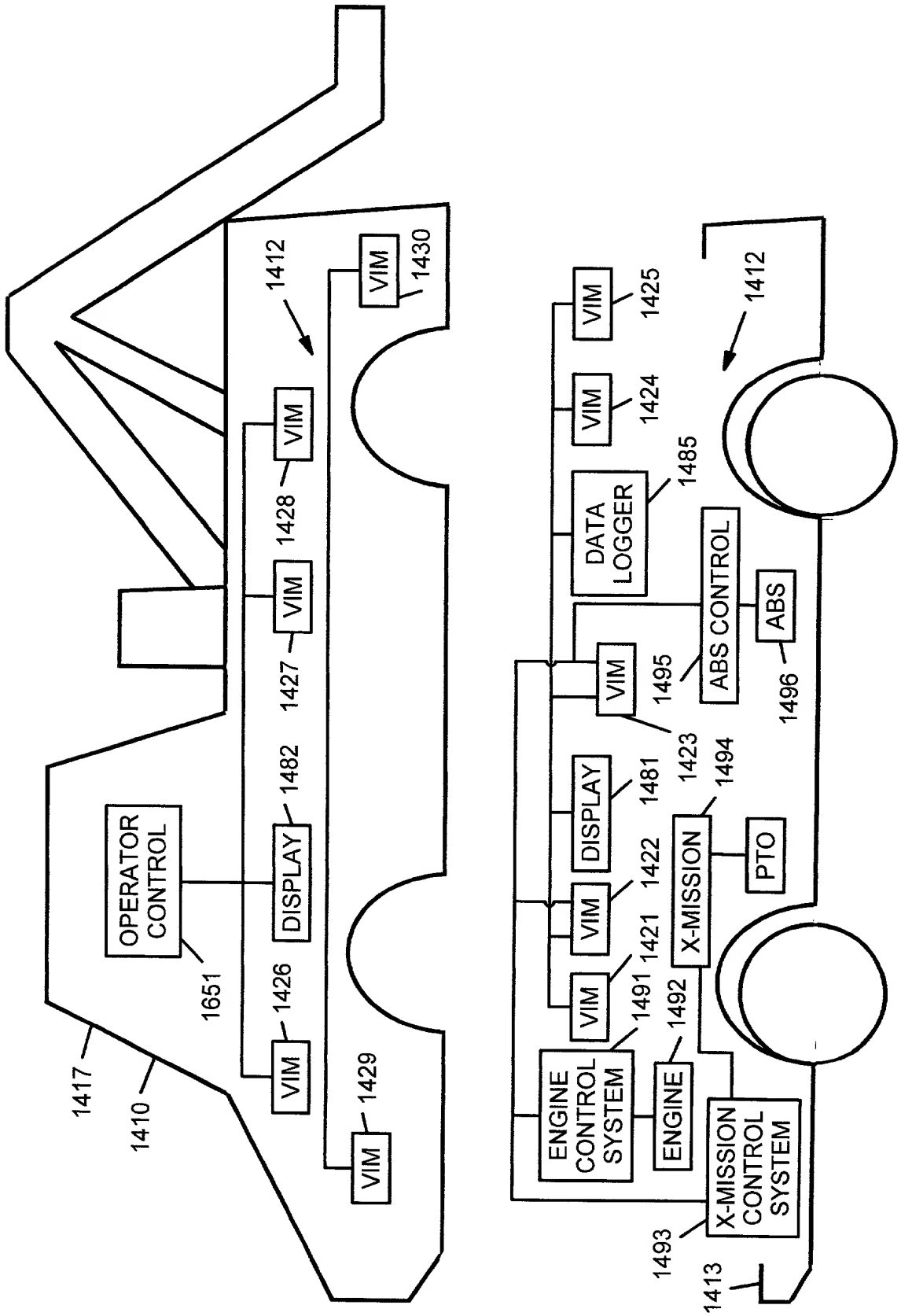
1412
1417
1410
1651
OPERATOR CONTROL
DISPLAY
1482
VIM
1426
VIM
1427
VIM
1428
VIM
1430
VIM
1429
1412
VIM
1425
VIM
1424
DATA LOGGER
1485
ABS CONTROL
ABS
1496
VIM
1495
DISPLAY
1481
1423
1494
VIM
1422
X-MISSION
PTO
VIM
1421
1491
1492
ENGINE CONTROL SYSTEM
ENGINE
X-MISSION CONTROL SYSTEM
1493
1413

FIG. 14

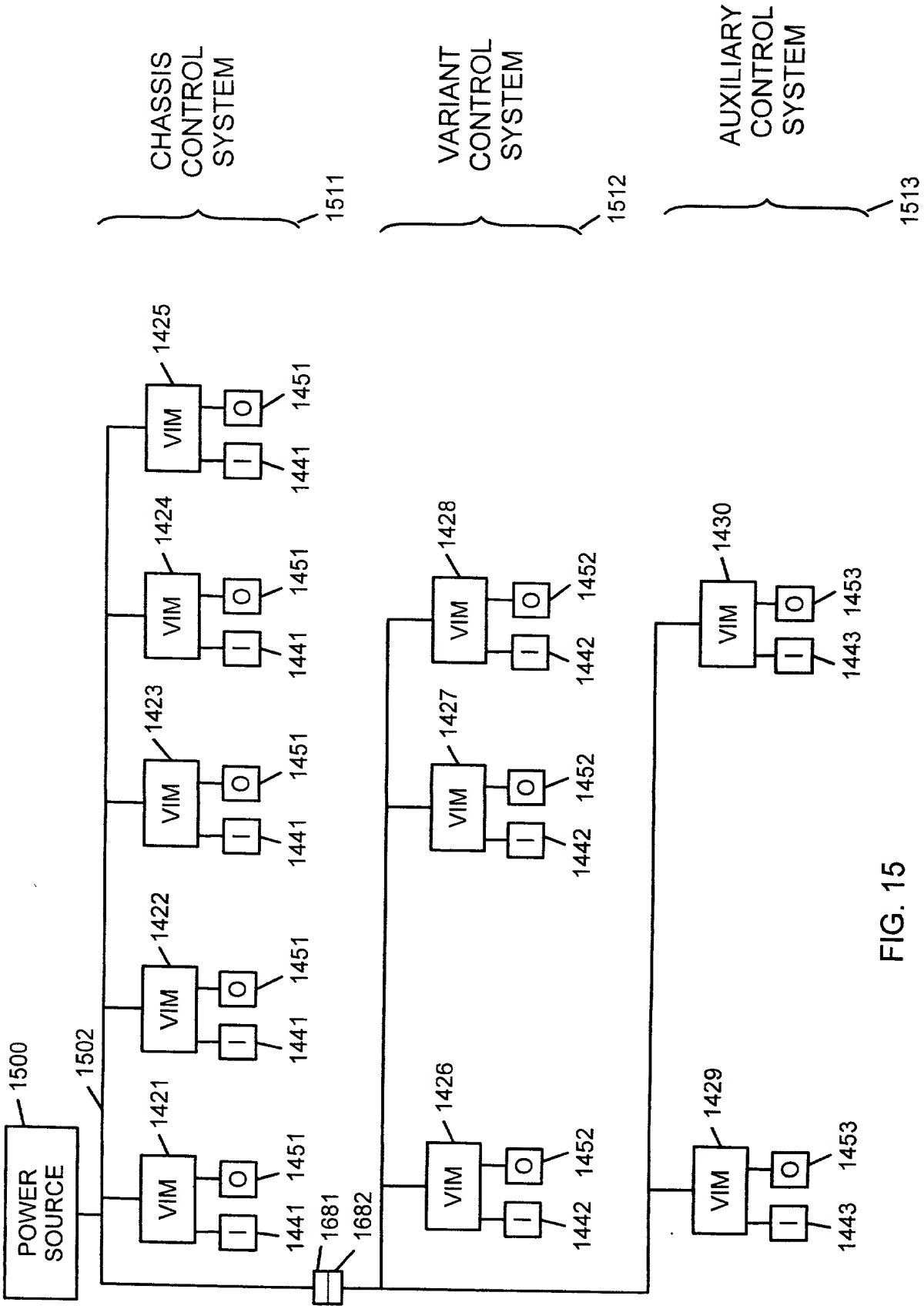
CHASSIS CONTROL SYSTEM
1511
VARIANT CONTROL SYSTEM
1512
AUXILIARY CONTROL SYSTEM
1513
POWER SOURCE
1500
1502
VIM
1421
1422
1423
1424
1425
1426
1427
1428
1429
1430
I
O
1441
1442
1443
1451
1452
1453
1681
1682

FIG. 15

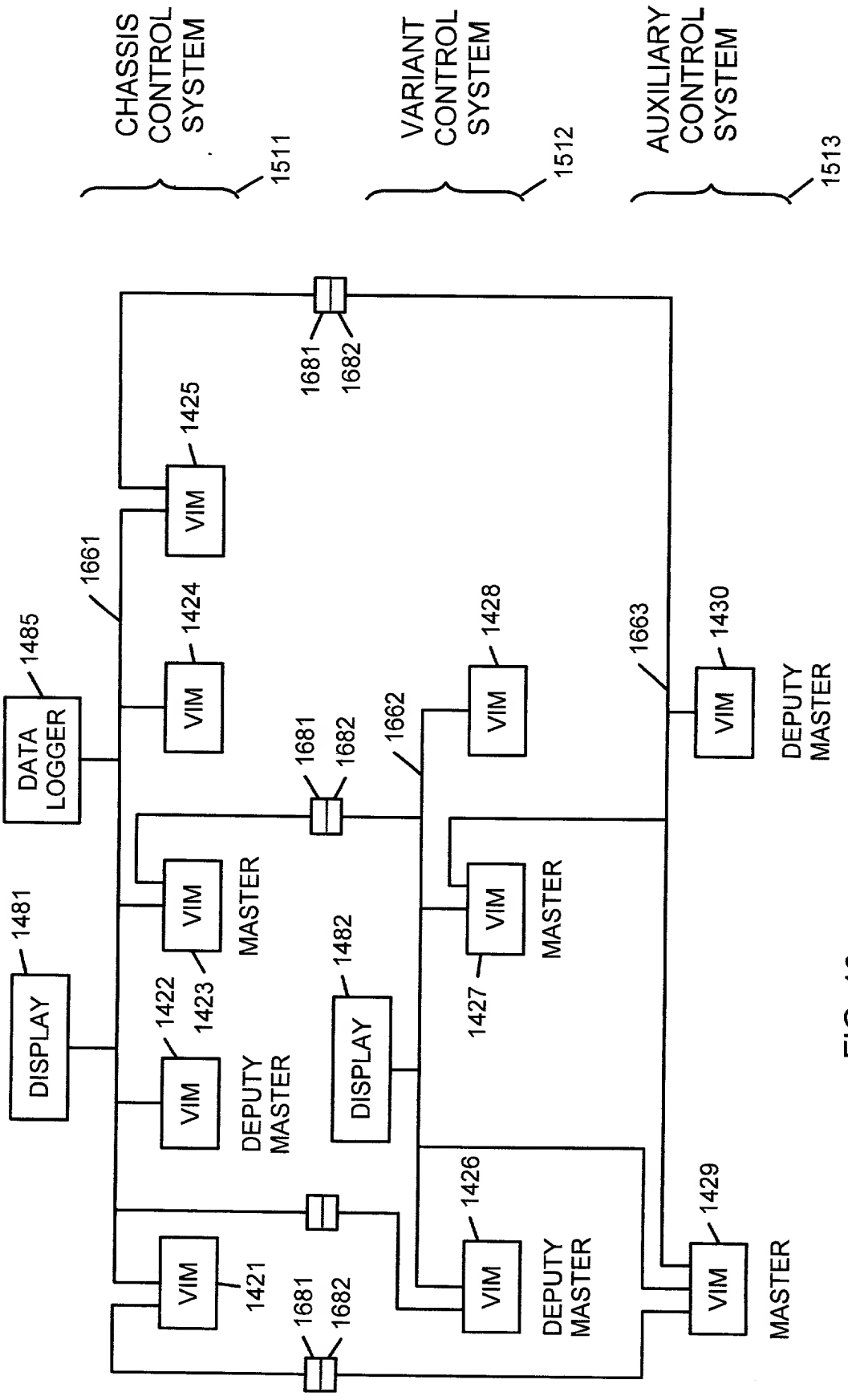
CHASSIS CONTROL SYSTEM
1511
VARIANT CONTROL SYSTEM
1512
AUXILIARY CONTROL SYSTEM
1513
1681
1682
1425
VIM
1661
1424
VIM
1485
DATA LOGGER
1681
1682
1662
1428
VIM
1663
1430
VIM
DEPUTY MASTER
1481
DISPLAY
VIM
1423
MASTER
1422
VIM
DEPUTY MASTER
1482
DISPLAY
1427
VIM
MASTER
1426
VIM
DEPUTY MASTER
1421
VIM
1681
1682
1429
VIM
MASTER

FIG. 16

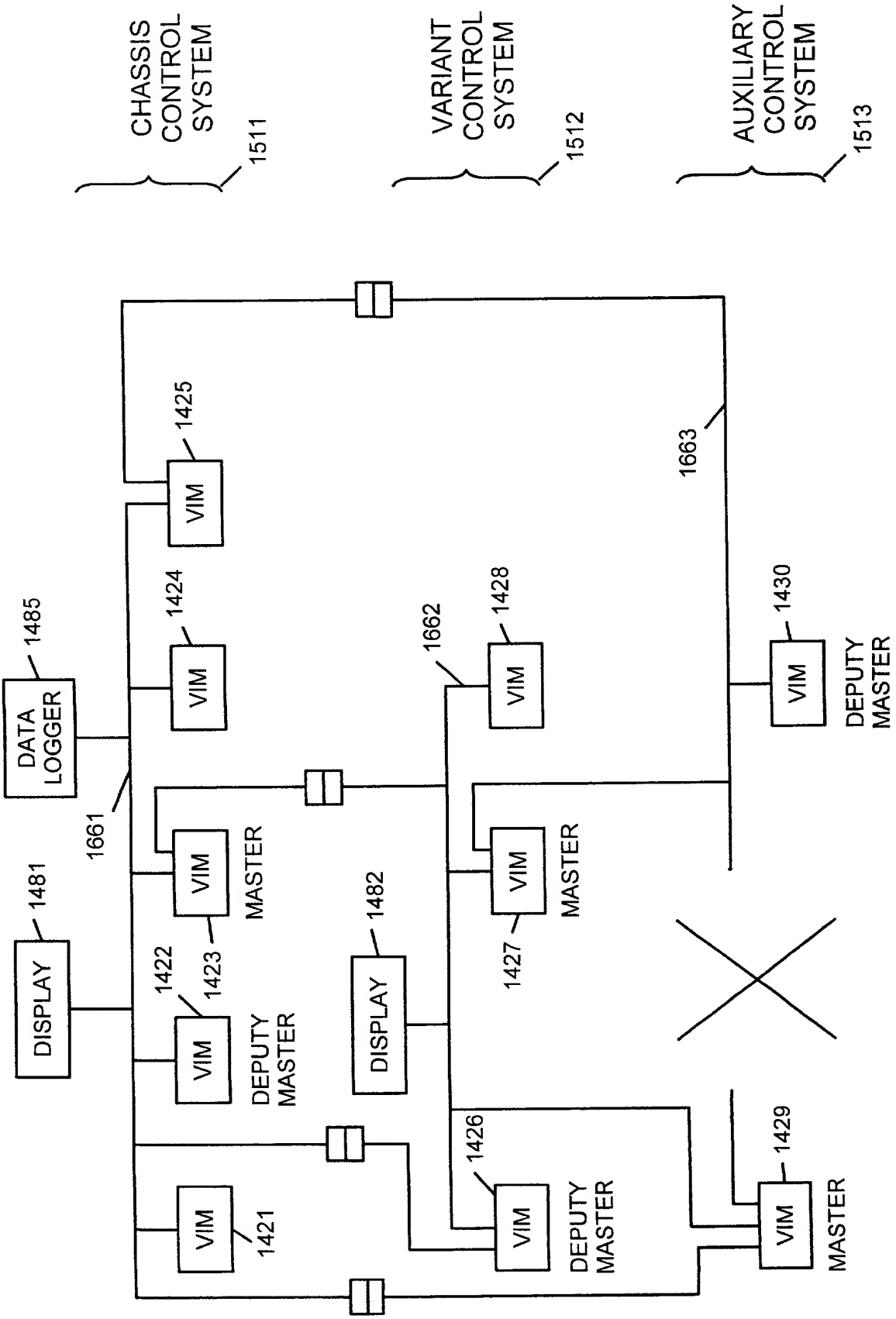
CHASSIS CONTROL SYSTEM
1511
VARIANT CONTROL SYSTEM
1512
AUXILIARY CONTROL SYSTEM
1513
DATA LOGGER
1485
DISPLAY
1481
DISPLAY
1482
VIM
1421
VIM
1422
VIM
1423
DEPUTY MASTER
VIM
1424
VIM
1425
VIM
1426
DEPUTY MASTER
VIM
1427
MASTER
VIM
1428
VIM
1429
MASTER
VIM
1430
DEPUTY MASTER
1661
1662
1663

FIG. 17A

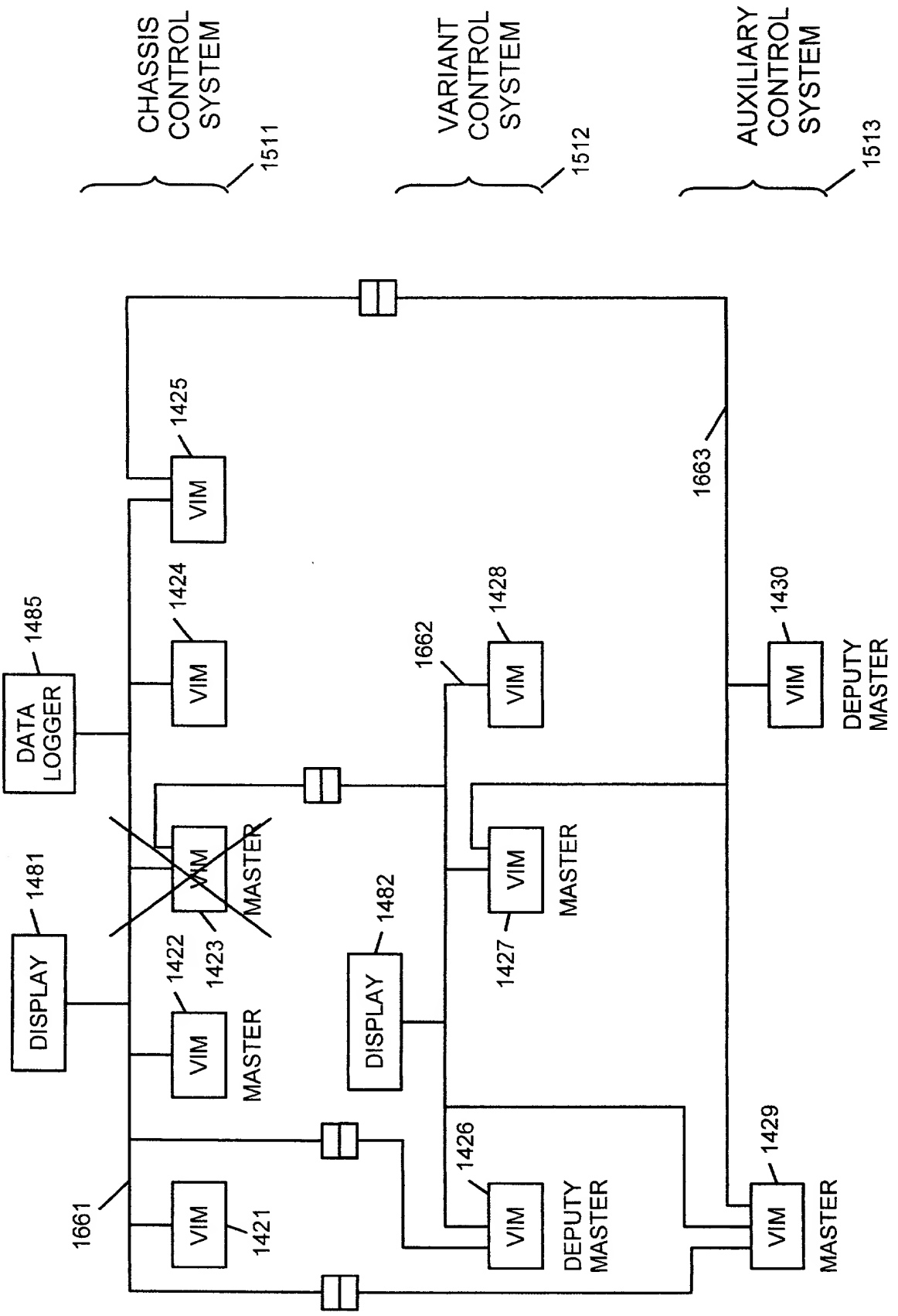
CHASSIS CONTROL SYSTEM
1511
VARIANT CONTROL SYSTEM
1512
AUXILIARY CONTROL SYSTEM
1513
DATA LOGGER
1485
DISPLAY
1481
DISPLAY
1482
VIM
1421
VIM
1422
MASTER
VIM
1423
MASTER
VIM
1424
VIM
1425
VIM
1426
DEPUTY MASTER
VIM
1427
MASTER
VIM
1428
VIM
1429
MASTER
VIM
1430
DEPUTY MASTER
1661
1662
1663

FIG. 17B

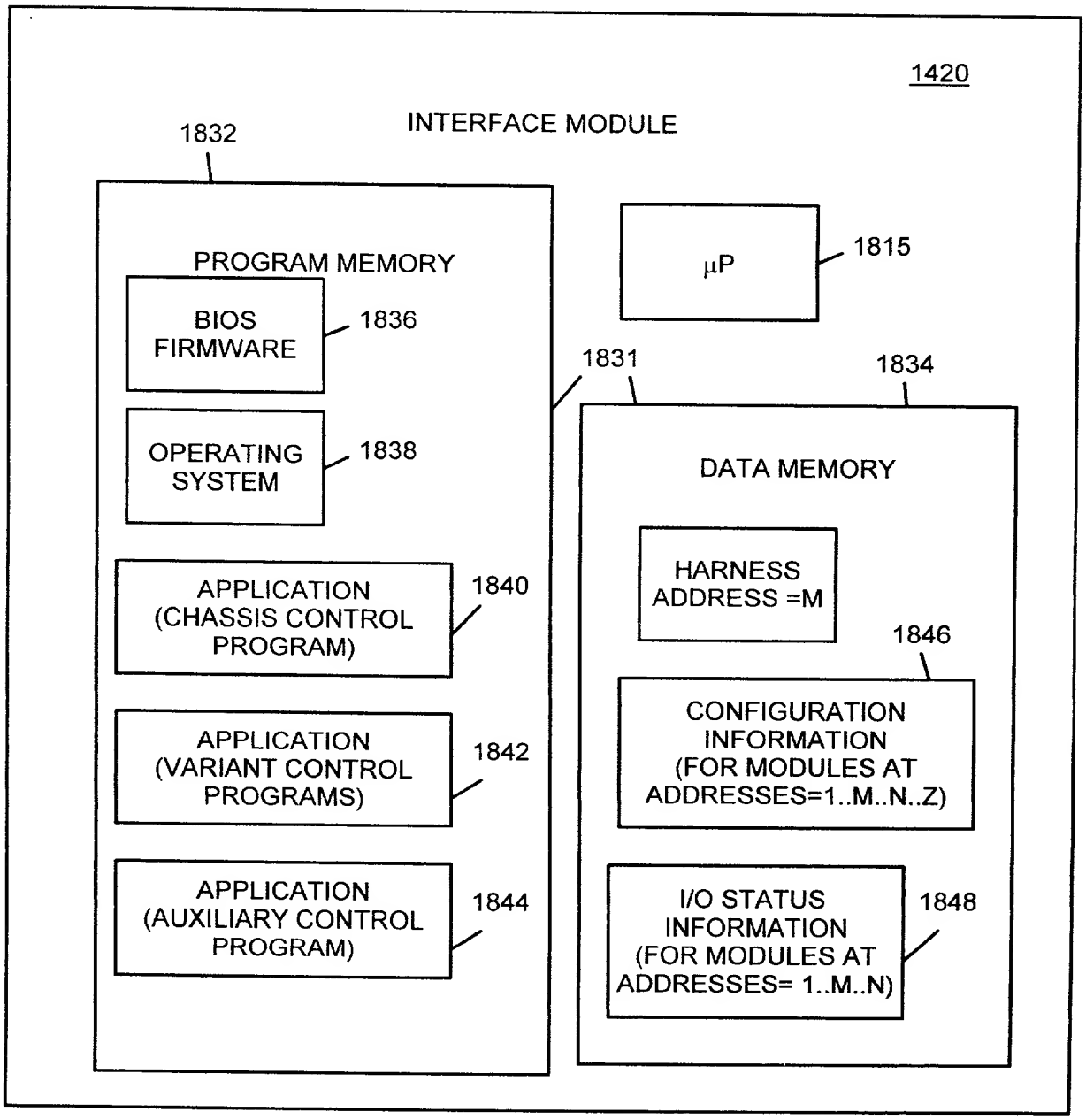
1420
INTERFACE MODULE
1832
PROGRAM MEMORY
BIOS FIRMWARE
1836
OPERATING SYSTEM
1838
APPLICATION (CHASSIS CONTROL PROGRAM)
1840
APPLICATION (VARIANT CONTROL PROGRAMS)
1842
APPLICATION (AUXILIARY CONTROL PROGRAM)
1844
μP
1815
1831
1834
DATA MEMORY
HARNESS ADDRESS =M
1846
CONFIGURATION INFORMATION (FOR MODULES AT ADDRESSES=1..M..N..Z)
I/O STATUS INFORMATION (FOR MODULES AT ADDRESSES= 1..M..N)
1848

FIG. 18

STATE	INPUT #1	INPUT #2	OUTPUT #1	OUTPUT #2
1	OFF	OFF	OFF	OFF
2	OFF	ON	ON	ON
3	ON	OFF	OFF	OFF
4	ON	ON	OFF	OFF
5	OFF	?	ON	OFF
6	ON	?	OFF	OFF
7	?	ON	OFF	OFF
8	?	OFF	OFF	OFF
9	?	?	OFF	OFF

FIG. 19

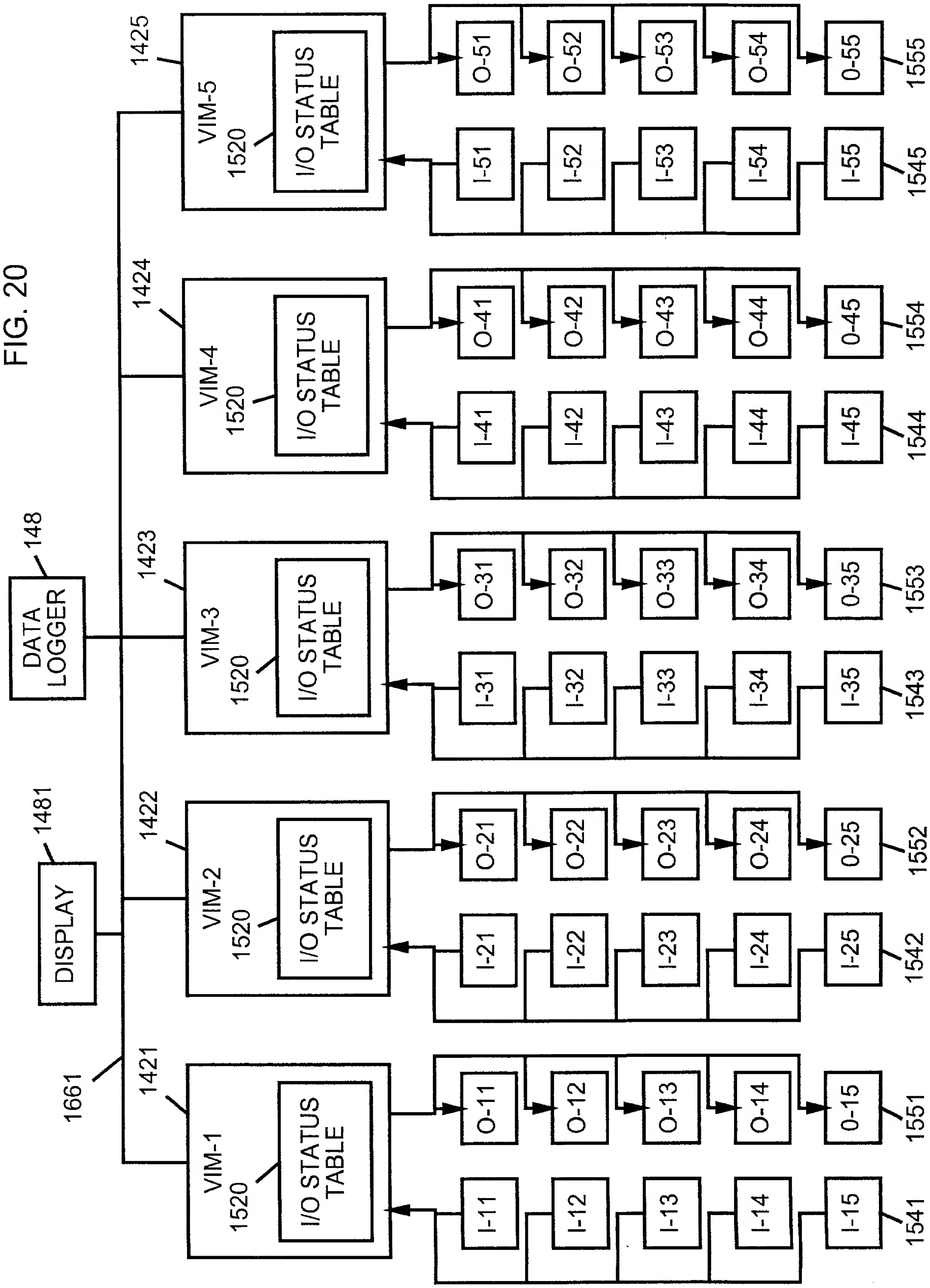
DISPLAY
1481
DATA LOGGER
148
1661
VIM-1
1421
VIM-2
1422
VIM-3
1423
VIM-4
1424
VIM-5
1425
1520
I/O STATUS TABLE
I-11
I-12
I-13
I-14
I-15
1541
O-11
O-12
O-13
O-14
0-15
1551
I-21
I-22
I-23
I-24
I-25
1542
O-21
O-22
O-23
O-24
0-25
1552
I-31
I-32
I-33
I-34
I-35
1543
O-31
O-32
O-33
O-34
0-35
1553
I-41
I-42
I-43
I-44
I-45
1544
O-41
O-42
O-43
O-44
0-45
1554
I-51
I-52
I-53
I-54
I-55
1545
O-51
O-52
O-53
O-54
0-55
1555

FIG. 20

1520

I-11	I-12	I-13	I-14	I-15	IM-11	O-11	O-12	O-13
O-14	O-15	I-21	I-22	I-23	I-24	I-25	IM-21	IM-22
O-21	O-22	O-23	O-24	O-25	I-31	I-32	I-33	I-34
I-35	O-31	O-32	O-33	O34	O-35	I-41	I-42	I-43
I-44	I-45	IM-41	O41	O-42	O-43	O-44	O-45	I-51
I-52	I-53	I-54	I-55	O-51	O-52	O-53	O-54	O-55

FIG. 21

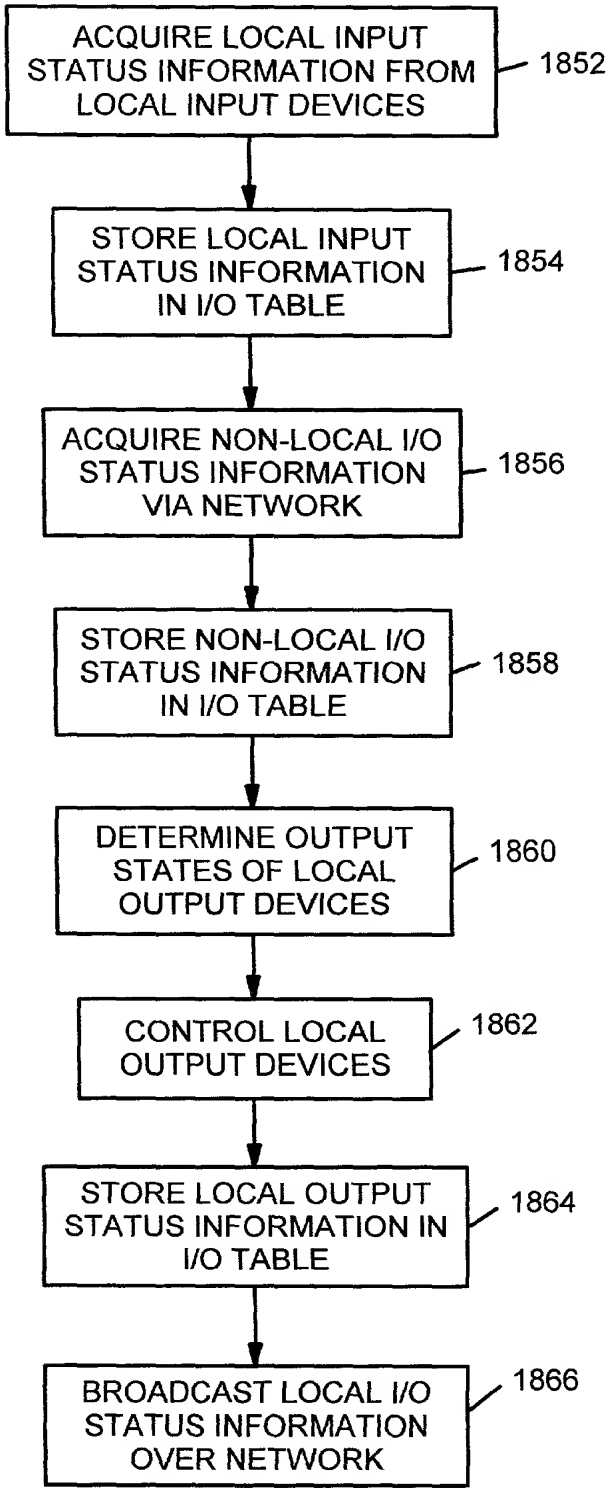
ACQUIRE LOCAL INPUT STATUS INFORMATION FROM LOCAL INPUT DEVICES
1852
STORE LOCAL INPUT STATUS INFORMATION IN I/O TABLE
1854
ACQUIRE NON-LOCAL I/O STATUS INFORMATION VIA NETWORK
1856
STORE NON-LOCAL I/O STATUS INFORMATION IN I/O TABLE
1858
DETERMINE OUTPUT STATES OF LOCAL OUTPUT DEVICES
1860
CONTROL LOCAL OUTPUT DEVICES
1862
STORE LOCAL OUTPUT STATUS INFORMATION IN I/O TABLE
1864
BROADCAST LOCAL I/O STATUS INFORMATION OVER NETWORK
1866

FIG. 22

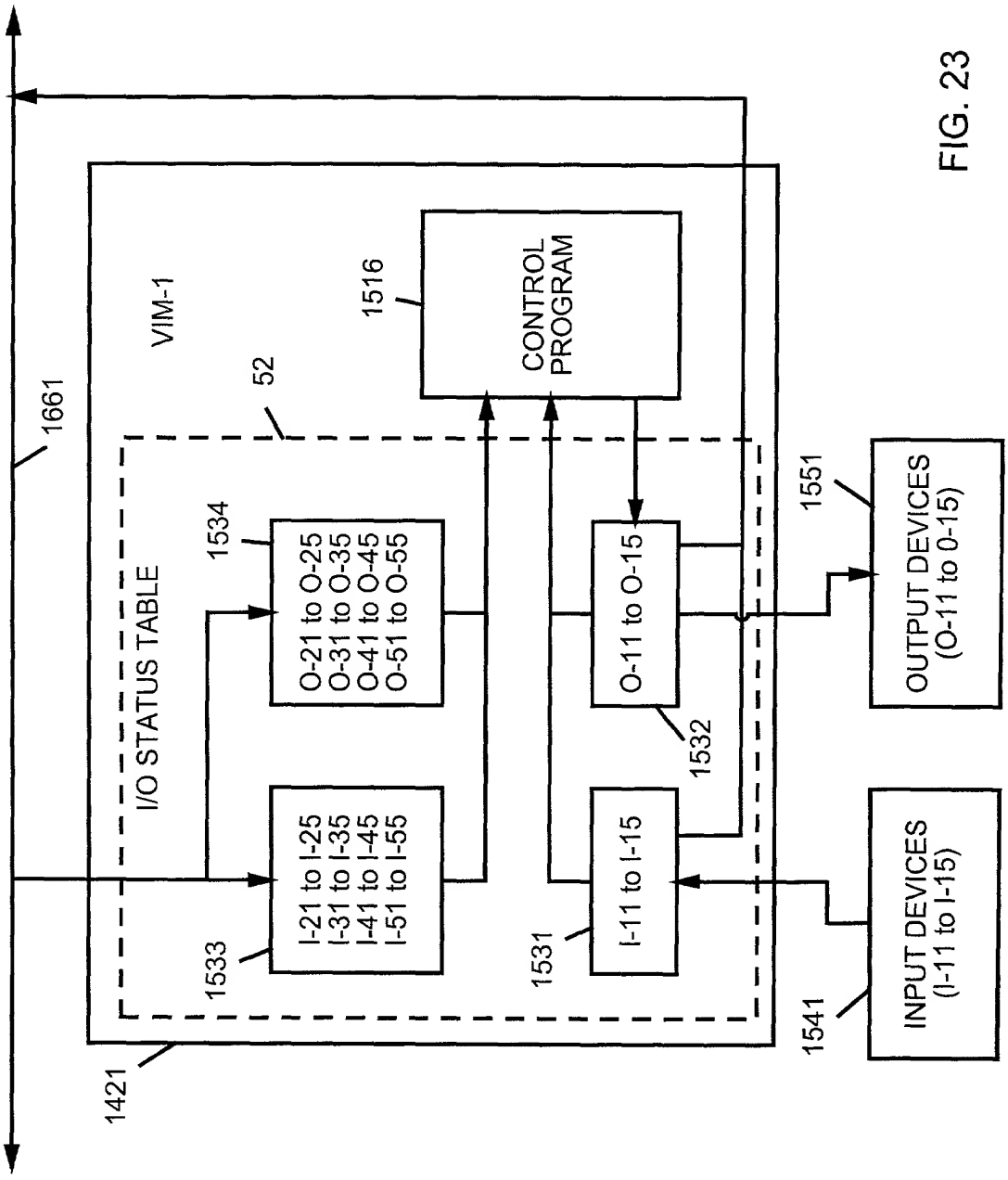
1661
VIM-1
52
1516
CONTROL PROGRAM
I/O STATUS TABLE
1534
O-21 to O-25
O-31 to O-35
O-41 to O-45
O-51 to O-55
O-11 to O-15
1551
OUTPUT DEVICES
(O-11 to 0-15)
1532
1533
I-21 to I-25
I-31 to I-35
I-41 to I-45
I-51 to I-55
1531
I-11 to I-15
1541
INPUT DEVICES
(I-11 to I-15)
1421

FIG. 23